

TYPE APPROVAL CERTIFICATE

This is to certify:

that the **Flexible Hoses of Non-Metallic Material with Permanently Fitted Couplings**

with type designation(s)

VENA PEM PURE, VENA PEM FUEL, VENA PEM COOL

issued to

VENAIR IBERICA, S.A.U.
Terrassa, BARCELONA, Spain

is found to comply with

DNV rules for classification – Ships Pt.4 Ch.6 Piping systems

DNV class programme DNV-CP-0183 – Type approval – Flexible non-metallic hoses

Application:

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Type:	Temperature range:	Max. working press.:	Sizes:
VENA	from 0°C up to 200 °C. It depends on	Up to 3.5 bar. It depends on size as	I.D. from 6
PEM	subsystem as per Application/Limitation	per Application/Limitation further in	mm up to
PURE	further in the certificate.	the certificate.	90 mm.
VENA	from 0°C up to 200 °C.	Up to 3.5 bar. It depends on size as	I.D. from 6
PEM		per Application/Limitation further in	mm up to
FUEL		the certificate.	90 mm.
VENA	from 0°C up to 110 °C.	Up to 3.5 bar. It depends on size as	I.D. from 6
PEM		per Application/Limitation further in	mm up to
COOL		the certificate.	90 mm.

Issued at **Hamburg** on **2024-03-13**

This Certificate is valid until **2029-03-12**.

for **DNV**

DNV local unit: **Area NB/CMC Iberia**

Approval Engineer: **Andre Pischanski**

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



Product description

The hose assemblies consist of non-metallic hoses with permanently fitted hose end fittings.
Hose assemblies may consist of different shaped parts (elbow, branch and reducer) as per end application.

Hose types

Type	Outer coating	Inner liner
VENA PEM PURE 3 plies	VMQ silicone	USP silicone
VENA PEM PURE 4 plies	VMQ silicone	USP silicone
VENA PEM PURE 5 plies	VMQ silicone	USP silicone
VENA PEM FUEL 3 plies	VMQ silicone	FKM with one layer of compound
VENA PEM FUEL 4 plies	VMQ silicone	FKM with one layer of compound
VENA PEM FUEL 5 plies	VMQ silicone	FKM with one layer of compound
VENA PEM COOL 3 plies	VMQ silicone	VMQ silicone
VENA PEM COOL 4 plies	VMQ silicone	VMQ silicone
VENA PEM COOL 5 plies	VMQ silicone	VMQ silicone

Hose sizes and reinforcement

Outer diameter [mm]	Reinforcement
≥ 6 and ≤ 38	Three plies of polyester fabric
≥ 39 and ≤ 51	Four plies of polyester fabric
≥ 52 and ≤ 90	Five plies of polyester fabric

Hose end fittings

Type	Material
End connector	Stainless steel grades 304 (1.4301), 316L (1.4404);
Embedded connector	Aluminium AL EN AW-6082-T6

Production places

Silicone Hoses Vietnam Co. Ltd., Unit A, Floor 2 – Standard Factory, Road 14, Tan Thuan EPZ – Tan Thuan Dong Ward, District 7, Ho Chi Minh City, Vietnam

Venair Clean Energy SLU, C/ Encofradores, 9 manzana I, parcela 2-3 , Polígono Industrial El Mugerón, 2ª fase 02640 ALMANSA (Albacete), Spain

Responsibility

The certificate holder, VENAIR IBERICA, S.A.U., takes the responsibility for the design and the production procedures with relation to ensuring continued consistent production of the type approved products.

Reference DNV CP-0338 Type approval scheme, Section 4.

Application/Limitation

Hose assemblies are type approved for use in fuel cell power installation as follows:

Fuel cell subsystem	Hose assembly type	Medium temperature range
Anode	PEM FUEL	0°C up to 200°C.
Cathode	PEM FUEL; PEM PURE	0°C up to 200°C.
Coolant: ethylene glycol/water mixture; distilled water	PEM PURE; PEM COOL	0°C up to 110°C.

Maximum working pressure depends on the hose size as follows. The smallest maximum working pressure shall be used for the manifolds consisting of different sizes.

Type	Maximum working pressure [bar]	Internal diameter
VENA PEM PURE	3.2	6 up to 38mm
	3.5	39 mm up to 51 mm
	2.8	52 mm up to 76 mm
	2.3	77 mm up to 90 mm
VENA PEM FUEL	3.2	6 up to 38mm
	3.5	39 mm up to 51 mm
	2.8	52 mm up to 76 mm
	2.3	77 mm up to 90 mm
VENA PEM COOL	3.2	6 up to 38mm
	3.5	39 mm up to 51 mm
	2.8	52 mm up to 76 mm
	2.3	77 mm up to 90 mm

The suitability for a specific application shall be ensured with respect to the applicable service conditions, e.g. medium type and temperature, flow velocity and installation area in the piping. In particular, deterioration during projected service life shall be considered. Refer to fuel cell maker's specification and DNV-RU-SHIP Pt.4 Ch.6 Sec.2 Materials. Leakage rate, defined by the maker, shall be considered for intended application, e.g. ventilation capacity for leakage dilution.

The type approval certificate covers only permanently fitted coupling listed above.

The use of other type/design of couplings is subject to approval on case-by-case basis for a specific fuel cell type.

Its safety shall be ensured by a fuel cell design, e.g. component assessment and safety measures.

It shall be approved by compliance documents Type Approval Certificate (TAC) or Product Certificate (PC) of the fuel type.

Production testing

Each hose assembly is subject to quality assurance as per the *Control Plan # 2023PFMEA002* and the *Process Failure Mode and Effects Analysis # 2023PFMEA002*.

Type Approval documentation

Tests carried out

Tested according to DNV-CP-0183 as follows

- Resistance against liquids
- Ozone resistance
- Cover adhesion test
- Change in length, leakage and burst pressure tests
- Dimensional check test;
- Helium leakage test

Marking of product

For traceability to this type approval each coupling is at least to be marked with:

Marking scope	Example
Maker's name	Venair
Type	VENA PEM PURE
Inner diameter	ID45 mm
Batch number – production place	<batch number> - 01 or 02*
Reference to Type Approval Certificate #	DNV-CP-0183 No: TAP00002FX

Footnote

* 01: Silicone Hoses Vietnam Co. Ltd., Unit A, Floor 2 – Standard Factory, Road 14, Tan Thuan EPZ – Tan Thuan Dong Ward, District 7, Ho Chi Minh City, Vietnam



Job ID: **262.1-036545-1**
Certificate no.: **TAP00002FX**

02: Venair Clean Energy SLU, C/ Encofradores, 9 manzana I, parcela 2-3 , Polígono Industrial El Mugrón, 2ª fase 02640 ALMANSA (Albacete), Spain

Periodical assessment

For retention of the Type Approval, a periodical assessment as per DNV-CP-0338 Sec.4 shall be performed by a DNV Surveyor in order to verify that the conditions for the Type Approval are complied with.

To check the validity of this certificate, please look it up in <https://approvalfinder.dnv.com>.